Description

Motor for a fuel pump

The invention relates to an electronically commutated motor for a fuel pump, comprising a rotor which is connected to a shaft in a rotationally fixed manner and has a plastic-bonded ferrite.

Electronically commutated motors in the form of commutatorless DC motors, so called electronic motors, are known. Such brushless DC motors are distinguished in that they do not require servicing and the cost of producing them is comparatively low. It is also known to provide such motors with a rotor which is arranged on a shaft and is composed of a permanent-magnet material, for example a plastic-bonded barium ferrite.

One problem with the known motors is that the rotor is permanently damaged when it comes into contact with gasoline or diesel fuel, as is unavoidable when the motors are used to drive fuel pumps. Furthermore, the motors have a large spectrum of efficiency which is dependent on further system parameters.

US-A-6 220 826 discloses an electronically commutated motor for a fuel pump of the type mentioned in the introduction.

US-A-6 204 584 discloses a rotor for an electrically commutated motor which has a tubular permanent-magnet body with alternating poles on the circumference and a return element protruding into its continuous cylindrical through-opening, said return element having a circular basic cross section and one or more pairs of flat areas on its lateral surface. Air gaps between the return element and the tubular permanent-

magnet body are formed by the flat areas. The return element can be adjusted by rotating the

return element in the permanent-magnet body.

US 6,455,975 B1 discloses a generator with a conical hub which is composed of a magnetic steel, whose lateral surface has a constant wall thickness and on which magnets are arranged.

The object of the invention is therefore to provide a motor of the type mentioned in the introduction for a fuel pump, which motor is highly efficient and at the same time has long service life.

According to the invention, this object is achieved in that the rotor has a fuel-resistant shaped body which is formed by the plastic-bonded ferrite, and in that a magnetic return element which can be adjusted in relation to the shaped body by being moved on the shaft is provided, with the shaped body having an axial recess in which the return element engages, with the axial recess having an opening side and a base side which is situated opposite the opening side and at which the shaped body is connected to the shaft, and with the axial recess forming a funnel which widens conically toward the opening side, and in that the return element forms a cone which tapers toward the base side of the recess.

The ability to adjust the return element in relation to the plastic-bonded ferrite which forms a shaped body makes it possible to match the magnetic flux specifically to the motor system while optimizing the efficiency of the motor. In this case, the shaped body allows deliberate interaction between the return element and the rotor which has two or more magnetic poles. The shaped body itself permanently retains

its shape even in a fuel environment, as a result of which not only the electromagnetic properties and the power output of the motor remain constant over time, but also an unbalance of the rotor which increases wear is reliably avoided.

Particularly exact association of the shaped body and return element along with high stability of the motor arrangement is achieved by moving the return element.

A particularly compact structure is achieved by the return element engaging in the recess.

It is possible to imagine forming the recess and shaped body in such a way that the return element engages fully through the shaped body. However, particularly high stability and easy installation of the motor arrangement are achieved when the axial recess has an opening side and a base side which is situated opposite the opening side and at which the shaped body is connected to the shaft.

The ability to adjust the return element in relation to the shaped body is considerably simplified by the recess being in the form of a funnel and the return element being in the form of a cone.

If, according to one advantageous development of the invention, the opening angle of the funnel corresponds to the cone angle of the cone, the magnetic flux can be matched particularly exactly to the motor system; the lateral surface of the cone and the corresponding inner face of the funnel are always parallel to one another in this case.

In principle, any desired fuel-resistant plastics which have high deformation resistance can be used as a support for the ferrite. However, polyphenylene sulfide (PPS) is a particularly advantageous plastic which bonds the ferrite, especially for providing the shaped body with a high degree of chemical resistance and very high dimensional stability. A further advantage of PPS is its inherent flame resistance. Since the ferrite is responsible for the permanent-magnet properties of the rotor, it is also expedient if it has a high coercive force.

According to one advantageous development of the invention which was discovered from experiments, the shaped body has stabilizing fiber material. A proportion by volume of approximately 2%

of glass fibers has proven particularly suitable and also cost-effective.

It is possible to imagine placing the shaped body, for example, onto the shaft and adhesively bonding them. In contrast, a particularly simple and long-lasting connection between the rotor and the shaft while at the same time avoiding an unbalance of the rotor is ensured when, according to another advantageous development of the invention, the shaped body is injection molded onto the shaft and, in a connecting region between the shaft and the shaped body, the shaft has a pattern which increases its surface roughness. This pattern may be, for example, a roughened section or - particularly advantageously - a knurled formation.

The motor can be produced in a particularly simple and cost-effective manner when, according to another advantageous development of the invention, the return element is pressed onto the shaft. In this case, the return element can be pressed onto the shaft, after the shaped body and shaft are connected, so as to ensure exact adjustment in relation to the shaped body.

One exemplary embodiment of the invention is illustrated in the drawing and described in greater detail in the following text. In the drawing, the single figure shows a partial sectional view of a motor for a fuel pump.

The figure is a schematic view of a rotor 1 of an